Notice of Allowability	Application No. 10/517,026	Applicant(s) LECLAIR, PHILIPPE	
	Examiner Jason M. Perilla	Art Unit 2611	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address--

All claims being allowable, PROSECUTION ON THE MERITS IS (OR REMAINS) CLOSED in this application. If not included herewith (or previously mailed), a Notice of Allowance (PTOL-85) or other appropriate communication will be mailed in due course. **THIS NOTICE OF ALLOWABILITY IS NOT A GRANT OF PATENT RIGHTS.** This application is subject to withdrawal from issue at the initiative of the Office or upon petition by the applicant. See 37 CFR 1.313 and MPEP 1308.

1. ☒ This communication is responsive to *the amendment filed August 20, 2007*.
2. ☒ The allowed claim(s) is/are *1-13*.
3. ☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
   a) ☒ All b) ☐ Some* c) ☐ None of the:
   1. ☐ Certified copies of the priority documents have been received.
   2. ☐ Certified copies of the priority documents have been received in Application No. _____ .
   3. ☒ Copies of the certified copies of the priority documents have been received in this national stage application from the International Bureau (PCT Rule 17.2(a)).

   * Certified copies not received: _____.

Applicant has THREE MONTHS FROM THE "MAILING DATE" of this communication to file a reply complying with the requirements noted below. Failure to timely comply will result in ABANDONMENT of this application.
THIS THREE-MONTH PERIOD IS NOT EXTENDABLE.

4. ☐ A SUBSTITUTE OATH OR DECLARATION must be submitted. Note the attached EXAMINER'S AMENDMENT or NOTICE OF INFORMAL PATENT APPLICATION (PTO-152) which gives reason(s) why the oath or declaration is deficient.
5. ☐ CORRECTED DRAWINGS (as "replacement sheets") must be submitted.
   (a) ☐ including changes required by the Notice of Draftsperson's Patent Drawing Review (PTO-948) attached
   1) ☐ hereto or 2) ☐ to Paper No./Mail Date _____.
   (b) ☐ including changes required by the attached Examiner's Amendment / Comment or in the Office action of Paper No./Mail Date _____.

   Identifying indicia such as the application number (see 37 CFR 1.84(c)) should be written on the drawings in the front (not the back) of each sheet. Replacement sheet(s) should be labeled as such in the header according to 37 CFR 1.121(d).
6. ☐ DEPOSIT OF and/or INFORMATION about the deposit of BIOLOGICAL MATERIAL must be submitted. Note the attached Examiner's comment regarding REQUIREMENT FOR THE DEPOSIT OF BIOLOGICAL MATERIAL.

Attachment(s)

1. ☐ Notice of References Cited (PTO-892)
2. ☐ Notice of Draftperson's Patent Drawing Review (PTO-948)
3. ☐ Information Disclosure Statements (PTO/SB/08), Paper No./Mail Date _____
4. ☐ Examiner's Comment Regarding Requirement for Deposit of Biological Material
5. ☐ Notice of Informal Patent Application
6. ☒ Interview Summary (PTO-413), Paper No./Mail Date *20070921*.
7. ☒ Examiner's Amendment/Comment
8. ☐ Examiner's Statement of Reasons for Allowance
9. ☐ Other _____.

EXAMINER'S AMENDMENT

1. Claims 1-13 are pending in the instant application.

2. An examiner's amendment to the record appears below. Should the changes and/or additions be unacceptable to applicant, an amendment may be filed as provided by 37 CFR 1.312. To ensure consideration of such an amendment, it MUST be submitted no later than the payment of the issue fee.

Authorization for this examiner's amendment was given in a telephone interview with Chris Hermanson on August 21, 2007.

The application has been amended as follows wherein the following versions of claims 1-5 and 8-13 replace all prior versions in their entirety:

1. An iterative method for decoding a signal vector Y obtained from N sampled signals in a space-time communication system with M transmission antennae and N receiving antennae, with N and M being integers and N greater than or equal to M, with a view to obtaining an estimation of symbols of ~~the~~ signals transmitted; characterized in that each iteration comprises the following steps:

- Pre-processing of the vector Y in order to maximize ~~the~~ a signal to noise+interference ratio in order to obtain a signal $\tilde{r}^{\ell}$,

- Subtraction from the signal $\tilde{r}^{\ell}$ of a signal $\hat{z}^{\ell}$ by means of a subtractor, the signal $\hat{z}^{\ell}$ being obtained by reconstruction post-processing of an interference between symbols of an iteration in progress from symbols estimated during a preceding iteration,

- Detection of a signal generated by the subtractor in order to obtain, for the iteration in progress, an estimation of the symbols of the signals transmitted;

and in that, the N signals being processed by time intervals T corresponding to ~~the~~ a time length of a linear space-time code associated with the signals transmitted ~~signals~~, the pre-processing step ~~involves~~ utilizes a matrix B in order to maximize the signal to noise+interference ratio, a transfer function of which is:

$$B^{\ell}=Diag\left(\frac{1}{\rho_{\ell-1}^{2}A_i^{\ell}+\frac{N_0}{E_S}}\right)_{1\leq i\leq MT}.C^H V^{\ell}$$

with $V^{\ell}=\left[\frac{1-\rho_{\ell-1}^{2}}{\frac{N_0}{E_S}}.C\cdot C^H+Id_N\right]^{-1}$; $A^{\ell}=diag\left(C^H\cdot V^{\ell}\cdot C\right)$;

wherein ℓ: iteration index; ρ: standardized correlation coefficient between ~~the~~ real symbols and ~~the~~ estimated symbols; N_0: noise variance; Es: mean energy of a symbol; C: extended channel matrix; Id_N: identity matrix of size N; C^H: conjugate transpose of C; i: index ranging from 1 to MT;

and in that ~~the~~ a post-processing step involves a matrix D for the reconstruction of the interference between symbols, a transfer function of which is:

$$D^{\ell}=B^{\ell}.C\cdot\rho_{\ell-1}-Diag\left[\frac{1}{\rho_{\ell-1}^{2}A_i^{\ell}+\frac{N_0}{E_S}}\right]_{1\leq i\leq MT}$$

2. The method according to claim 1, wherein the pre-processing step is carried out by operating a matrix multiplication between the signal vector Y and a matrix B, the matrix B being updated at each iteration.

3. The method according to claim 1, wherein the post-processing step is carried out by operating a matrix multiplication between the ~~vector of the symbols estimated~~ estimation of the symbols of the signals transmitted during the preceding iteration and the matrix D, the matrix D being updated at each iteration.

4. The method according to claim 2, wherein for each iteration, the standardized correlation coefficient ρ is calculated and the matrix B is updated, the updating of ~~a~~ the matrix B being achieved by determining new coefficients of the matrix B as a function of the correlation coefficient obtained for ~~the~~ a preceding iteration.

5. The method according to claim 1, wherein in order to determine the correlation coefficient ρ^{ℓ} for each iteration:

- the signal to noise+interference ~~interference~~ ratio SINR for each iteration is calculated using the following formula: $SINR^{\ell} = \left[\frac{1}{\xi^{\ell} e^{\xi^{\ell}} E_1\left(\xi^{\ell}\right)} - 1\right]\frac{1}{1-\rho_{\ell-1}^{2}}$

and defining the integral exponential $E_1(s) = \int_{s}^{+\infty} \frac{e^{-t}}{t} dt$

with $\xi^{\ell} = \frac{\varsigma}{1-\rho_{\ell-1}^{2}}$ and $\varsigma = \frac{N_0}{NE_S}$

- ~~the~~ a symbol error probability Pr is calculated from the signal to noise+interference ~~interference~~ ratio $SINR^{\ell}$ for each iteration; and

- the correlation coefficient ρ^{ℓ} for each iteration is then calculated from the respective symbol error probability Pr for the given iteration.

8. The method according to claim 7, wherein, in obtaining an estimation of the symbols of the signals transmitted, ~~the~~ a formula corresponding to ~~the~~ a constellation originating from a linear modulation transmission technique is used.

9. The method according to claim 5, wherein in order to calculate the correlation coefficient ρ^{ℓ} for each iteration using its respective ~~from the~~ symbol error probability Pr, it is assumed that when there is an error, ~~the~~ a threshold detector detects one of ~~the~~ among closest neighbors to ~~the~~ a symbol transmitted.

10. The method according to claim 1, wherein at ~~the~~ a final iteration, ~~the~~ a signal leaving the subtractor is introduced into a soft-input decoder.

11. The method according to claim 1, wherein ~~the~~ information symbols of the N sampled signals are elements of a constellation originating from ~~a~~ quadrature amplitude modulation.

12. A space-time decoder ~~implementing a method according to claim 1~~ for decoding a signal vector Y obtained from N sampled signals in a space-time communication system with M transmission antennae and N receiving antennae, with N and M being integers and N greater than or equal to M, with a view to obtaining an estimation of symbols of ~~the~~ signals transmitted, characterized in that it comprises:

- a pre-processing module of the vector Y for maximizing ~~the~~ a signal to noise+interference ratio in order to obtain a signal $\tilde{r}^{\ell}$,

~~- a subtractor for subtracting a signal $\hat{z}^{\ell}$ from the signal $\tilde{r}^{\ell}$,~~

- a post-processing module for ~~the~~ reconstruction of an interference between symbols from symbols estimated during a preceding iteration in order to generate the signal $\hat{z}^{\ell}$,

- a subtractor for subtracting a signal $\hat{z}^{\ell}$ from the signal $\tilde{r}^{\ell}$,

- a threshold detector for detecting a ~~the~~ signal generated by the subtractor in order to obtain, for ~~the~~ an iteration in progress, an estimation of the symbols of the signals transmitted;

and in that the N sampled signals being processed by intervals of time T corresponding to ~~the~~ a time length of a linear space-time code associated with the signals transmitted ~~N sampled signals~~, the pre-processing module ~~consists of~~ utilizes a matrix B for maximizing the signal to noise+interference ratio, a transfer function of which is:

$$B^{\ell}=Diag\left(\frac{1}{\rho_{\ell-1}^{2}A_{i}^{\ell}+\frac{N_0}{E_S}}\right)_{1\leq i\leq MT}.C^{H}V^{\ell}$$

with $$V^{\ell}=\left[\frac{1-\rho_{\ell-1}^{2}}{\frac{N_0}{E_S}}C\cdot C^{H}+Id_N\right]^{-1};\quad A^{\ell}=diag\left(C^{H}\cdot V^{\ell}\cdot C\right);$$

wherein ℓ: iteration index; ρ: standardized correlation coefficient between the real symbols and the estimated symbols; N_0: noise variance; Es: mean energy of a symbol; C: extended channel matrix; Id_N: identity matrix of size N; C^H: conjugate transpose of C; i: index ranging from 1 to MT;

and in that the post-processing module consists of a matrix D for the reconstruction of the interference between symbols, a transfer function of which is:

$$D^{\ell}=B^{\ell}.C\cdot\rho_{\ell-1}-Diag\left(\frac{1}{\rho_{\ell-1}^{2}A_{i}^{\ell}+\frac{N_0}{E_S}}\right)\quad 1\leq i\leq MT$$

13. The decoder according to claim 12, wherein it further comprises a soft input decoder receiving the signal ~~originating~~ generated from the subtractor during a final iteration.

Allowable Subject Matter

3. Claims 1-13 are allowed.

Conclusion

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Jason M. Perilla whose telephone number is (571) 272-3055. The examiner can normally be reached on M-F 8-5 EST.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Chieh M. Fan can be reached on (571) 272-3042. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

Jason M. Perilla
September 24, 2007

jmp

CHIEH M. FAN
SUPERVISORY PATENT EXAMINER